V, 1242 1125' Venus #5 NE-NE 30

- 889 fngl.

889 - 1064 Ls fngl. more Ls scarn w/ increase in depth

867 EOH 11/22/70 also Qtzte, some clastics. Some

zones become monolithic all healed in

semi cons. state by silt or $CaCO_3$.

979-994 skarn frags. Cu_2S Cu_2O Cu

1064 - 1125 EOH 2/21/72 Red fngl.

981 - 1004 23' .69% Cu

Kelly Ext.

981
980

Hole Logs

✓1259 E side Sec. 20 near 1/4 Cor

358-650 Fangl. mnz wk to loc. fair Cu Ox

✓980 Fan group NW-SE 19

to 1434 fangl. occ. 6" of .3-.6 Cu

✓981 700' SE of 980 SE-SE 19

Fngl. to 2050 2050-±2100 much shearing

some granitic I 2051-53 Q.M.P.? broken

weak $CuFeS_2$ 2055½-2073 seds.

2053½-2055½ 8.5% Cu garnetite near massive $CuFeS_2$

2055.5-2061 .3 cu

2099-2111 grad. Q.M. loc. porph. bio bks up to 1/4"

numerous to 3/8 feld. phenos. Abund K feld. along

along seams prob. 2nd. trace FeS_2 + $CuFeS_2$

along stringers.

check log by J.K. 2073-2099 could be gr. not clear cut.

2099-2111 grad change to Q.M looking very

much like the "granodiorite" w/ bio in discrete bks.

✓1308 SE-SW 21

4-197 gray Ls w/ some change

197-384 med. to dk gray fossil. Ls

384-500 med. " " chert(y) fossil Ls.

500-594 dk. to lt. gray fossil. Ls. some sandy

594-631 EOH SS. to Qtzte.

Reenter 1308

631-664 Qtzt.
-685 Ls.
-993 Qtzt.
-998 L
-1160 EOH alternating Ls. sills. qtzl. + tuff (?)

✓ 483 801' Fan gr. NE-SW ~~SW-SE~~ 19

to 215 fngl. (grad ch. at 215)
215- Ls. fragmental cemented
329-344 strong dissem. CuOx loc. grns & pods Cu_2S
garnet + partly alt. Ls.
344-352 calc. sil. argillite wk. CuOx.
352-378 congl. possible brec. sil. Ls. garnet.
minor to strong Fe_3O_4 + Cu_2S CuOx
poss. Cu_2O chalcedony.
378-484 Ls fangl. minor to med. CuOx
w/ possible Cu_2S
484-494 garnet to garnetized ls partly fragmtl.
partly strong CuOx. trace to med. Cu_2S
494-524 silicated silty ls. wk to strong Cu_2S, $CuFeS_2$
occ. Qtz stringers rare $CaCO_3$ stringers.
524-569 Argillite Cu_2S + $CuFeS_2$
569-601 garnetite FeS_2 $CuFeS_2$ loc Sulf. smeared
601-830 calc. sil hornfels short garnetite zones
776-780 Dike and (QMP) [illegible] [illegible]

483
~~308~~ cont.

830 - 869 sil. alt. Lmy stts.
841 - 869 mod. to strong $CuFeS_2$ dissem + stringers
occ. stringer Chalcedony
(869 - 946 (EOH) Fangl.
slicks on Ct. 1" gyp. seam 60°

325 - 378	mnz.	± av.	.8 - 1%
481 - 515	mnz.	"	"
569 - 603	"	± "	.75%
661 - ~~665~~ 681	"	± "	.5%
841 - 869	"	± "	.5%

✓ ~~#~~ 273 Ann Sullinger # 31 Claim (SW corner) (1961)
map shows 1192 log 757.5' all Helmet
map SW - SW 16 near Sec. Cor.

✓ A - 975 1246' Fan just N of Dynamite SE - SE 19? SW - SE 19
to 309 fngl. ~~fragmental~~
309 - 413 fragmental garnetite calc. sil. ls.
rare serp. + chl. rare sil. feldspathic Qtzt.
in garn. sil. calcareous matrix
loc. Chalcedony Qtz. stringers
wk to mod Cu_2S occ. rimming $CuFeS_2$
413 - 465 garnetized rock.
465 - 469.5 bx.
- 485 alt sil. garn. ls.
485 - 581 Sil Ls well altered. poor core rec.
in spots + many pulls.

975 Cr...

581 - ~~649~~ 651 sil + chl. siltst Dx.

651-688 fair bunches + seams FeS_2 slightly > $CuFeS_2$

finely diss. Fe_3O_4 some Qtz + chalcedony

688-763.5 shattered rock well alt. thin MoS_2

intrusive ct. fairly sharp. 2" zone at 60°

-791 QMP. lt. gray very well alt. porph.

some glassy Qtz eyes. white pinkish mod. to strg. clay + ser alt. felds. and aph. grd. mass of strongly alt. mat. Rock gully crumbly + broken by number shears + faults wk diss. + seamlike FeS_2 > $CuFeS_2$ + MoS_2

some seams $CaCO_3$ + $CaSO_4$

-812 about same less mnz.

812 ↘ ↗ Fangl. ~~and~~ Ct. dubious at 40°

1246 EOH

Mnz.	309 - 378	Av. ±	± .8% Cu
	378 - 444	"	± .18 "
	444 - 485	"	± .75
	548 - 560	"	± .35
	568 - 574	"	± .75
	574 - 614	"	± .18
	643 - 695	"	± .7

✓976 1500' SESE 19

to 138 alluvium.

- 183 frags. alt Ls. sil. Ls. loc. cement

Fe Ox loc. masses & seams Chalc. Qtz.

Loc. appears shattered in part prob. congl.

loc. gnt. bl. Cu Ox st.

loc. garn. Ls.

183-374 (cont. indistinct) Congl. poorly sorted

ang. frag. ls. in sandy silt very calc. matrix

little chalced. Qtz in matrix.

374-~~477~~ 492½ No Ct. L avail.

Poss. Ls congl.(?) ~~b~~ x alt. Ls. w/ chalced

seams. Calc. talc. like alt.

very wk CuS dissem. Cu Ox on fractures.

loc. garnetite

492½ - to 1500 Fngl.

✓977 3W-3E 19

0-166 all.

166-171 caliche congl.

171-230 fngl.

230-332 Ls. Congl.

332-387 Ls Bx to Congl.

387-603 Qtz. garnet. Ls., sil Ls.,
sil. limy Slts,

603-696 increase in slts.

696-709 Intrusive fine gr. Qtz., cream K spar
prob. Qtz monz, mod. to strong alt.
very wk. $CuFeS_2$, trace MoS_2
contact uncertain.

709- very fine to fm gr. feldspathic Qtzt.
trace $CuFeS_2$ mostly in clayey material

723½ Ct. ±60° fngl.

393-403 ±.25% Cu

567-~~638~~ 642 ±.5% -

713-723.5 .25%

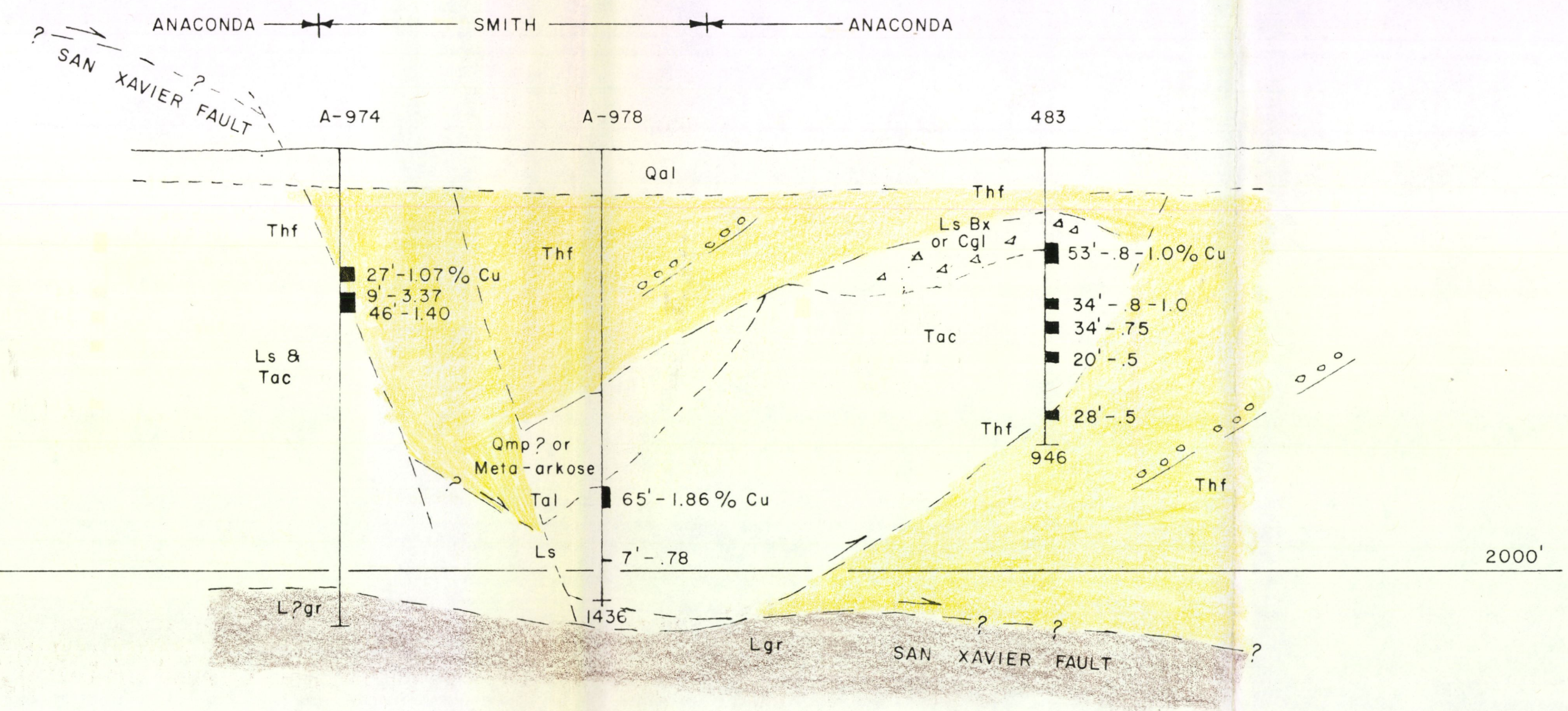
✓1039 Cont.

484 - 618 Serp. Ls.
618 - 737 str. alt. QMP bx
737 - 752 EOH Serp. Ls. 9/9/66
118 - 142 av ± .6 % Cu
373 - 399 " ± .5 "
419 - 448 ± .4 "

✓1091 800' SW-SE 19 Fan #5
- 522 Cong. + Fangl.
522 - 722 Alt blue gray Ls. w/ some Q[illegible]
722 - 800 EOH Fngl.

523 - 572	49'	0.13 % Cu
572 - 602	30'	.26
602 - 640	38'	.48
640 - 703	63'	2.10
(602 - 703	101	1.49)
703 - 722	19'	.10

✓1183 2514' Tuesday #6 N of Edwards NE-NE 18
79 - 215 Turkey track andes. to
- 1499 Fngl.
1300 - 1499 few to numerous chips rhy tuff or poss. inter fangl. tuff.
1499 - start NX core
- 1706 EOH Fngl. occ. slices 1551' sl.√ 45°
1635 - 2514 EOH Bio. Rhy. tuff.



EDWARDS COPPER

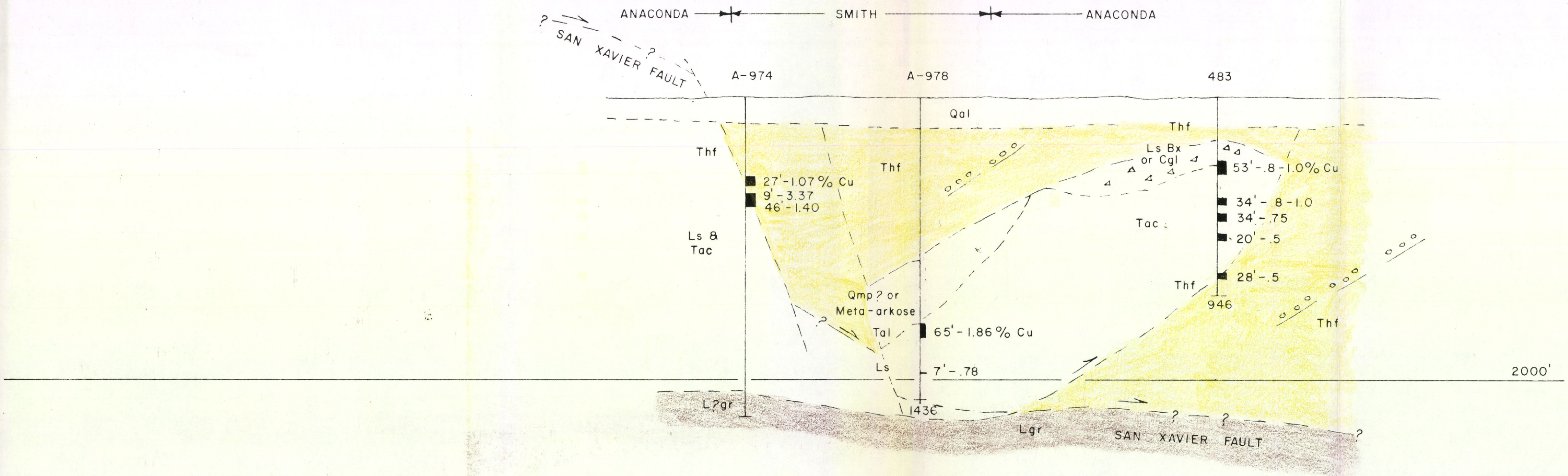
SECTION C-C'

LOOKING WEST

SCALE: 1" = 500'

J. E. KINNISON

JUNE, 1976



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SECTION C-C'

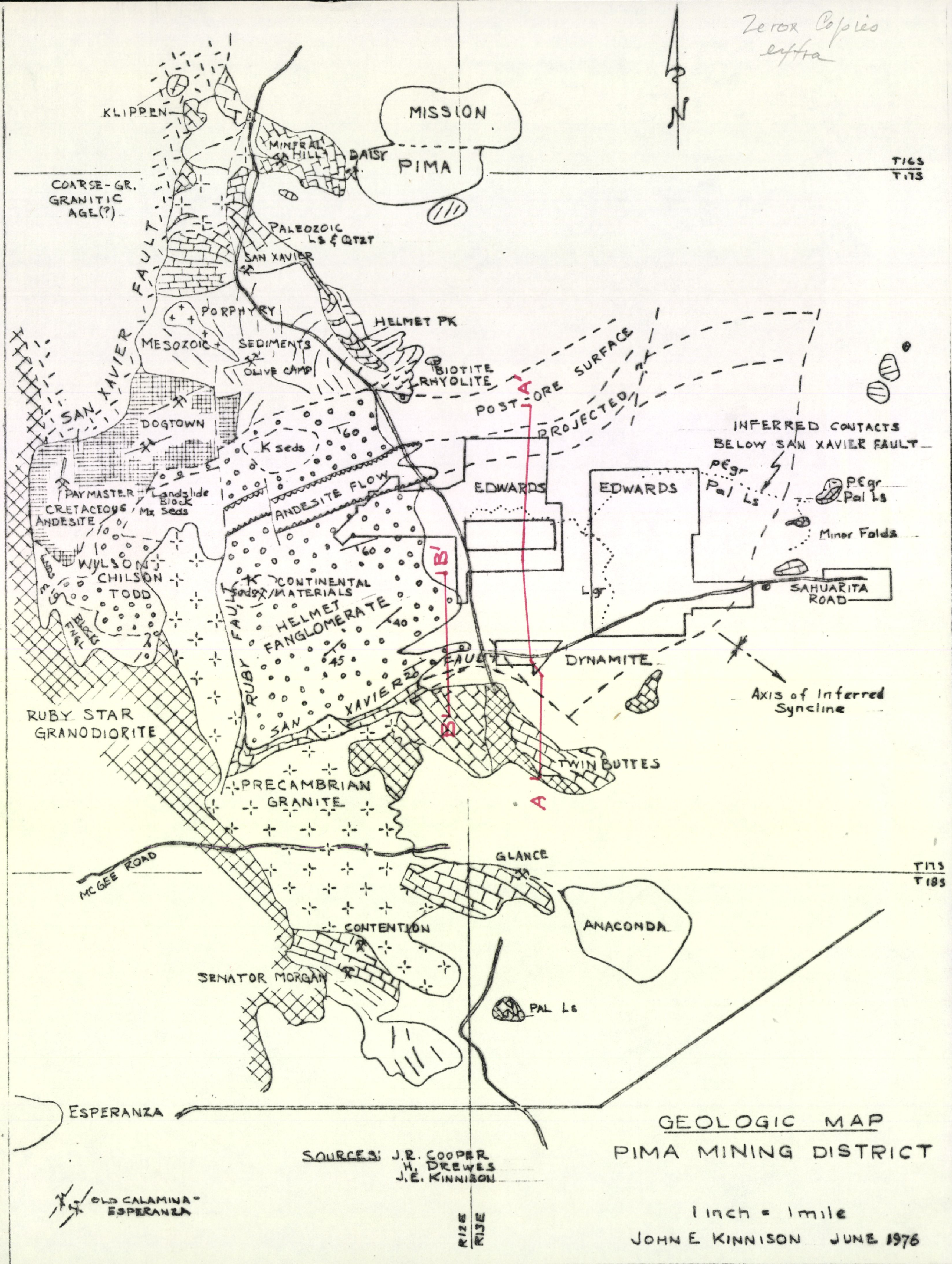
LOOKING WEST

SCALE: 1" = 500'

J. E. KINNISON

JUNE, 1976

Zerox Copies extra



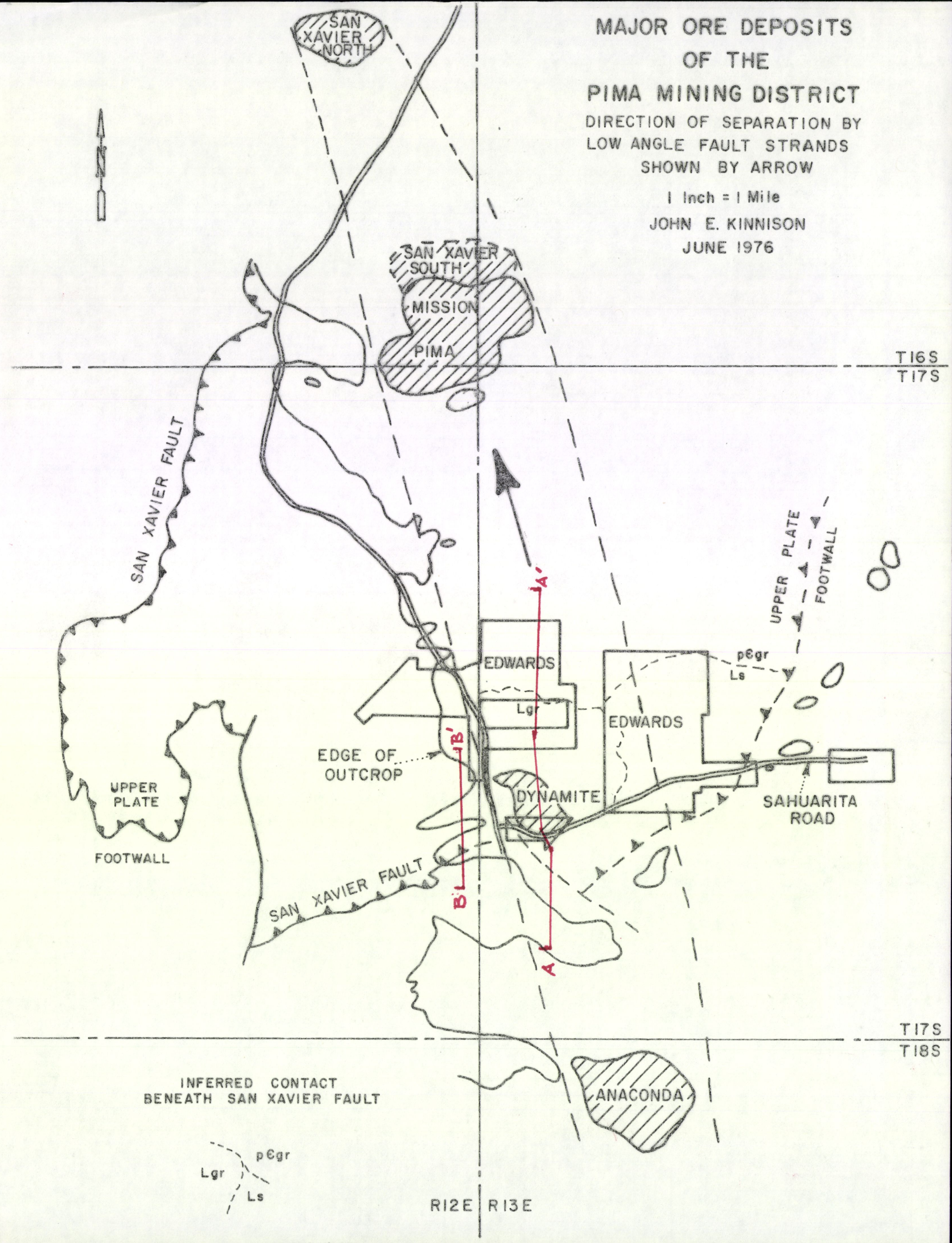
GEOLOGIC MAP

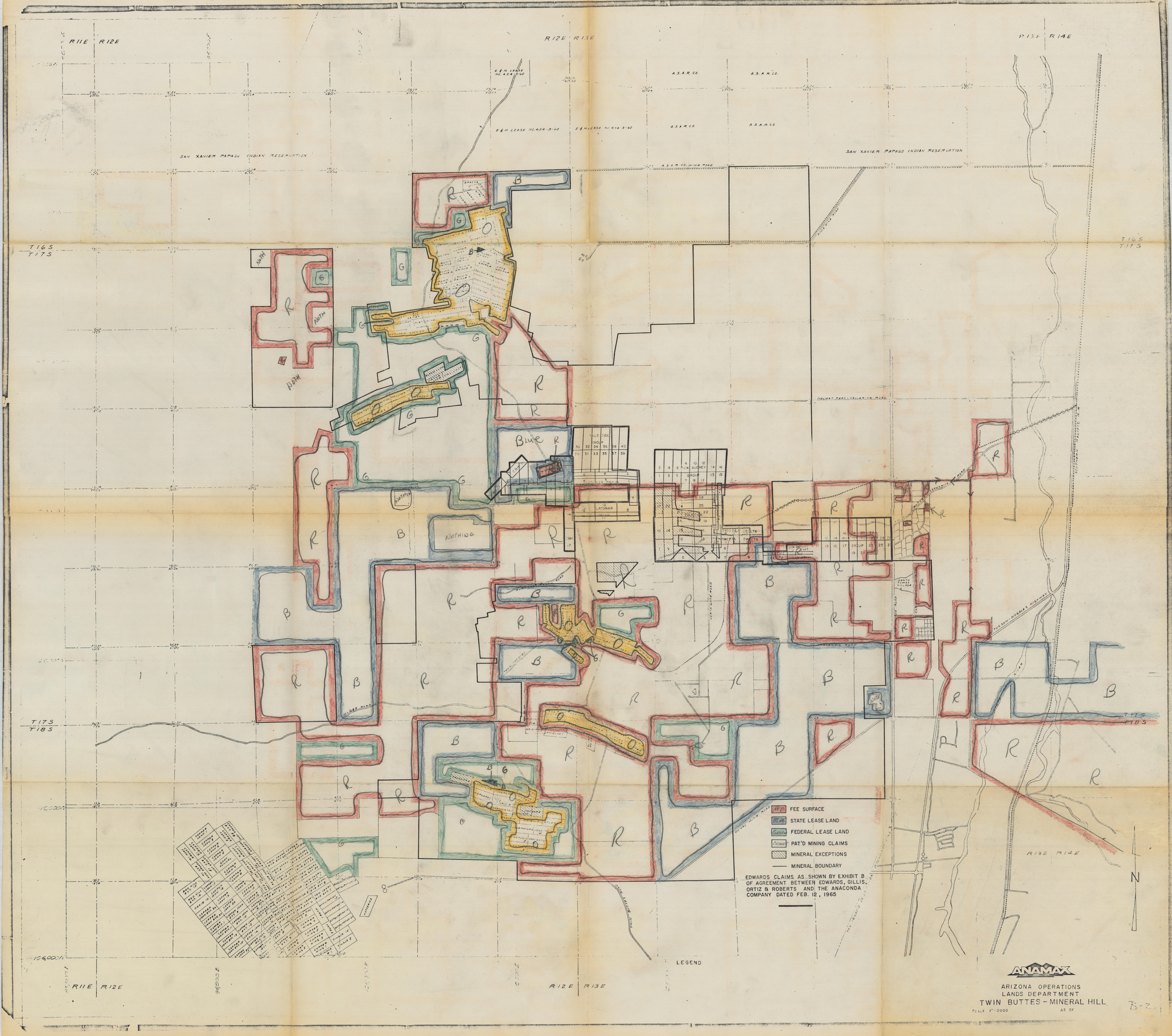
PIMA MINING DISTRICT

SOURCES: J.R. COOPER
H. DREWES
J.E. KINNISON

1 inch = 1 mile

JOHN E KINNISON JUNE 1976


MAJOR ORE DEPOSITS
OF THE
PIMA MINING DISTRICT
DIRECTION OF SEPARATION BY
LOW ANGLE FAULT STRANDS
SHOWN BY ARROW
1 Inch = 1 Mile
JOHN E. KINNISON
JUNE 1976
N
SAN XAVIER NORTH
SAN XAVIER SOUTH
MISSION
PIMA
T16S
T17S
SAN XAVIER FAULT
A'
A
B'
B
UPPER PLATE
FOOTWALL
EDWARDS
EDWARDS
Lgr
pЄgr
Ls
EDGE OF OUTCROP
DYNAMITE
SAHUARITA ROAD
UPPER PLATE
FOOTWALL
SAN XAVIER FAULT
T17S
T18S
ANACONDA
INFERRED CONTACT
BENEATH SAN XAVIER FAULT
pЄgr
Lgr
Ls
R12E R13E


R11E R12E
R12E R13E
R13E R14E
T16S
T17S
T18S
SAN XAVIER PAPAGO INDIAN RESERVATION
A.S.A.R.CO.
NOTHING
DUVAL MINE ROAD
SAN IGNACIO DE LA CANOA BOUNDARY LINE
FEE SURFACE
STATE LEASE LAND
FEDERAL LEASE LAND
PAT'D MINING CLAIMS
MINERAL EXCEPTIONS
MINERAL BOUNDARY
EDWARDS CLAIMS AS SHOWN BY EXHIBIT B OF AGREEMENT BETWEEN EDWARDS, GILLIS, ORTIZ & ROBERTS AND THE ANACONDA COMPANY DATED FEB. 12, 1965
LEGEND
N
ANAMAX
ARIZONA OPERATIONS
LANDS DEPARTMENT
TWIN BUTTES - MINERAL HILL
SCALE 1" = 2000
AS OF
B-2

CORDEX EXPLORATION COMPANY
SUITE 207
511 EAST SECOND STREET
RENO, NEVADA 89502
(702) 322-7833

July 29, 1976

Mr. John Kinnison
Consulting Mining Geologist
5450 N. Bowes Road
Tucson, Arizona 85715

Dear John:

I have been away for several days and just received your report on the Edwards property.

You have done an excellent job on this and it will help us greatly in deciding whether we want to do any exploration work on the ground.

What is interesting is how you show the Lgr-Ls contact extending for almost one mile within the east block of the Edwards ground. This of course should be where tactite ore might develop.

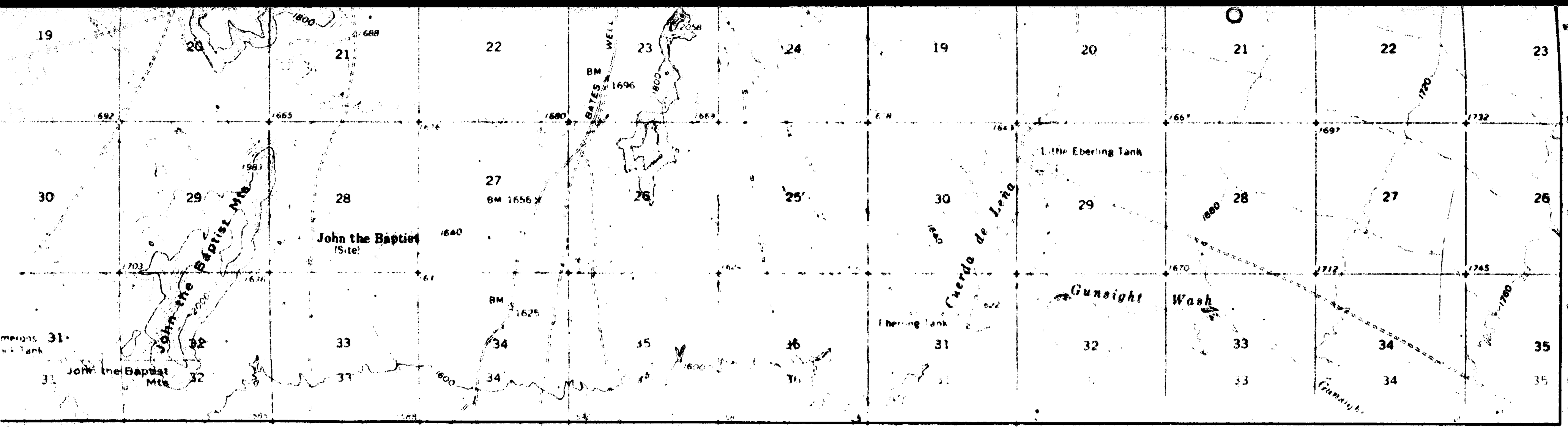
The big problem is whether there is any chance of finding a grade good enough for block caving. And the irregular nature of this mineralization would make it very difficult and costly to prove up an ore-body.

Best regards.

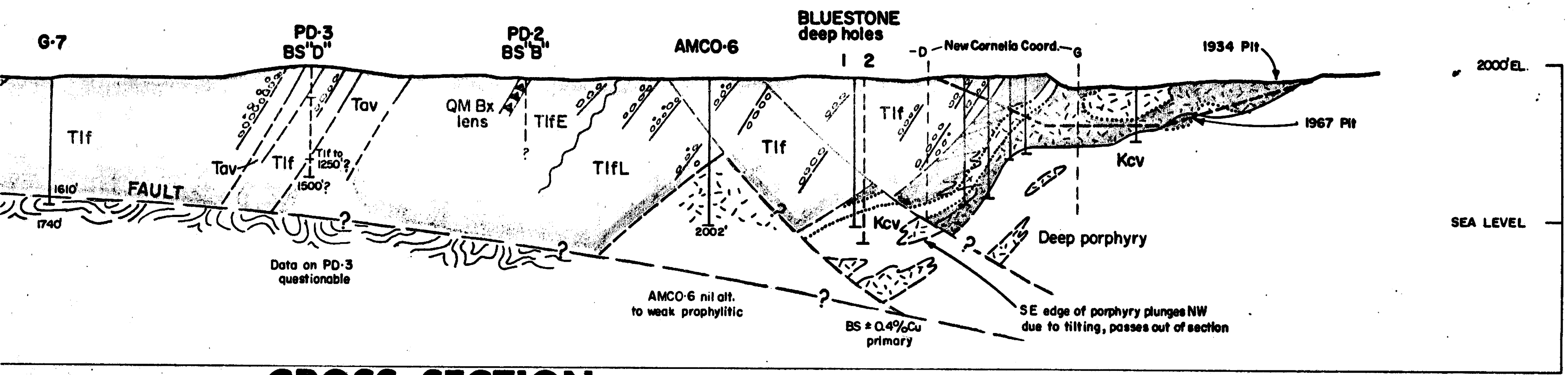
Sincerely yours,

JSL:jh

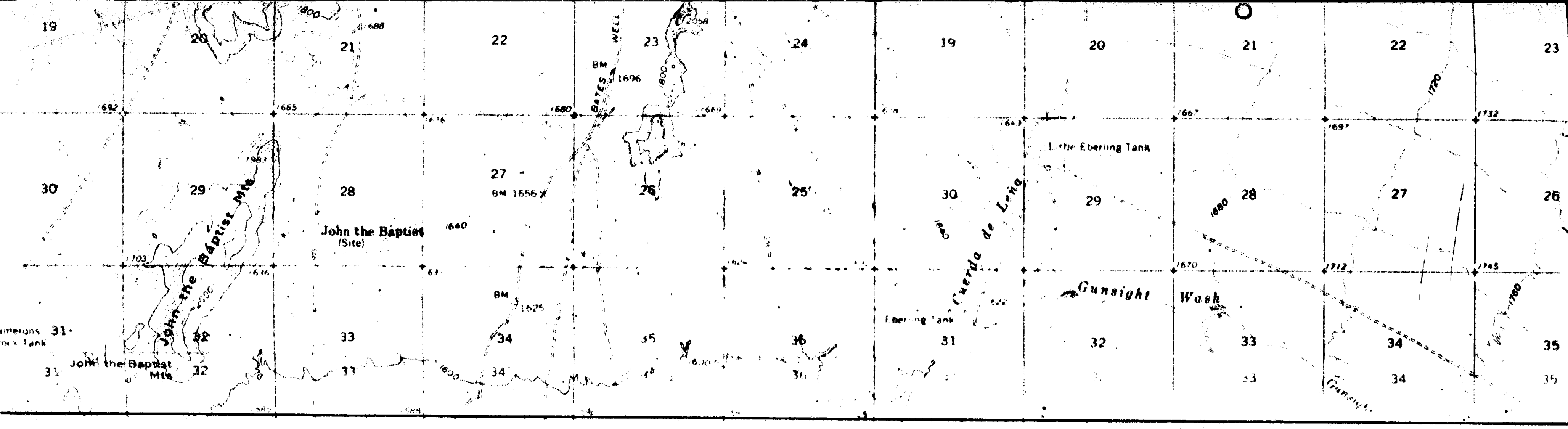
J. S. Livermore



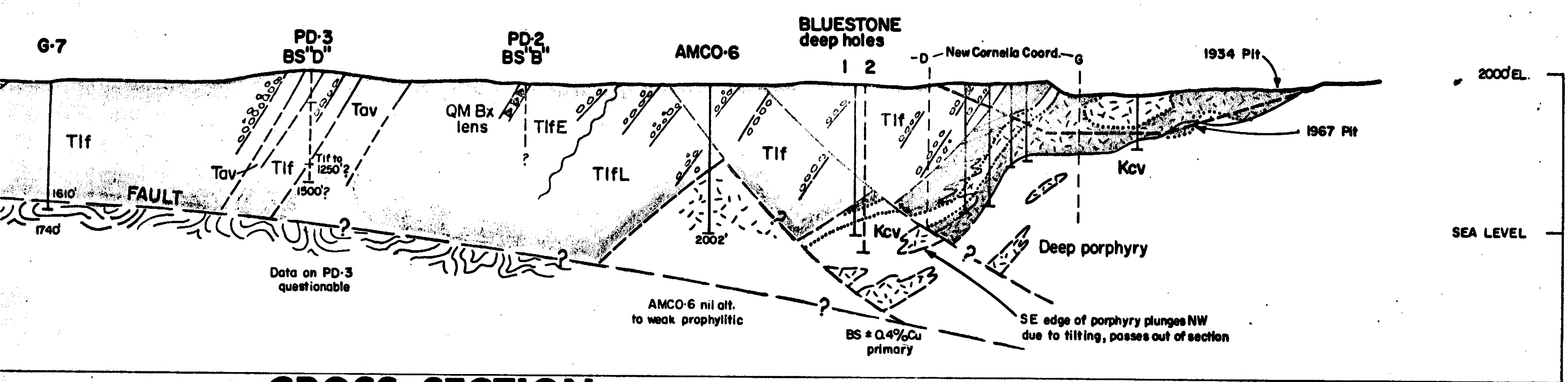
DRILL HOLE LOCATION MAP
1"- 1 MILE



CROSS SECTION
LOOKING WESTERLY
1"- 2000'



DRILL HOLE LOCATION MAP
1"= 1 MILE



CROSS SECTION
LOOKING WESTERLY
1"= 2000'

MONOLITHOLOGIC BRECCIAS

The lenses and tongues of breccia here interpreted as part of the Helmet fanglomerate characteristically consist of recemented breccia derived from a single pre-Helmet formation. Some breccia bodies consist of parts of two or more formations (pl. 1). In many parts of the breccia, it is clear that individual fragments have moved by rotation and translation with little if any churning movement. Formational contacts and even small-scale features like individual beds can be traced through intensely brecciated rock. To preserve these primary features, the entire mass of breccia must have been emplaced in essentially one piece. Landslides are probably the principal emplacement mechanism.

A landslide origin is best established for thin lentils wholly surrounded by conglomerate. The largest and best exposed of these lentils forms a low ridge 1½ miles south-southeast of Helmet Peak. This lentil is a few feet to about 200 feet wide and at least 3,500 feet long. The total length is not known as the eastern end is concealed by alluvium. The lentil is composed of brecciated and recemented beds of the Scherrer formation and the Concha limestone. The contacts between individual beds and between the two formations are still discernible and are parallel to the long axis of the lentil. The breccia fragments are rarely more than a few inches in diameter. Both contacts of the lentil are exposed and dip southeast parallel to bedding in the conglomerate. Although minor slippage may have taken place along the contacts, there is no evidence of large fault movement.

Other thin lentils of brecciated Paleozoic and Cretaceous (?) rocks and of granodiorite are found in the fanglomerate, but many of these lentils are too poorly exposed to map. Boulders of the same rock type that makes up the lentil are commonly abundant in the conglomerate on strike with the lentil, suggesting that the lentil was emplaced while the conglomerates were accumulating. The only alternative to contemporaneous emplacement, emplacement by post-Helmet faulting, is improbable. The concordance of the lenses and their small to moderate size and wide geographic and stratigraphic dispersal are difficult to explain by faulting. Furthermore, stratigraphic markers in the fanglomerate, such as the andesite flows and the lower red unit, are not repeated as one would expect if post-Helmet faulting had been involved.

Concordant tabular masses of monolithologic breccia that resemble the lentils just described have been reported from many localities in and on the valley-fill deposits of northern Arizona, southern Nevada, and southern California. In all the descriptions that I have found, the breccia masses have been interpreted as contemporaneous in origin with the deposits that contain them. Some have been interpreted as remnants of thrust plates that rode on the surface and as huge blocks that were shoved by such thrust plates (Longwell, 1949, p. 935, 947–50). Others have been interpreted as landslides, some of which moved 5 miles or more from their source (Woodford and Harriss, 1928, p. 279–290; Noble, 1941; Jahns and Engel, 1949, 1950; Longwell, 1951). The recent slides evidently broke off active fault scarps (Longwell, 1951) and off thrust plates that were moving on the surface (Woodford and Harriss, 1928, p. 289–90). The source of the older slides is obscure.

The thin lentils in the Helmet fanglomerate are similar to each other and probably have a similar origin. None of them is thick enough to transmit the force necessary to have shoved it into place. If there were only one lentil, one might suppose that it was part of a much thicker thrust plate that was eroded before burial. To assume many thrust plates all deeply eroded before burial is to stretch geologic probability beyond its limits. The most likely interpretation is that the lentils represent landslides.

The monolithologic breccias here assigned to the Helmet fanglomerate (pl. 1) include some large masses of breccia for which a landslide origin is only tentatively suggested. Near the base of the formation are large outcrops of arkose and granodiorite breccia. The distribution of these outcrops suggests that they are parts of a single body of breccia 10,000 feet long and as much as 4,000 feet wide, offset by the Ruby fault. At both ends, the body appears to lie within the red unit of the fanglomerate. In lithology, shape, and apparent geologic relations, the body resembles the probable landslide block in the SW¼ sec. 23, T. 17 S., R. 12 E. Furthermore, it appears to be out of place with respect to the pre-Helmet rocks to the north.

Interpretation of the large body as a landslide block is doubtful because it is less thoroughly brecciated than smaller landslide bodies, and some of the brecciation was pre-Helmet; it is unusually large for a landslide; and it lies so near the bottom of the Helmet that it can be interpreted as part of the basement on which the fanglomerate was deposited. In the NW¼ sec. 22, T. 17 S., R. 12 E., unbrecciated granodiorite cuts arkose breccia. In a contact hornfels zone several feet wide, the breccia has been healed by recrystallization and contains porphyroblasts of biotite and alkalic feldspar. The brecciation at this locality was older than the granodiorite, and does not indicate structural disturbance during Helmet time. If the body was emplaced as a single landslide block, this block was at least 10,000 feet long and 3,300 feet thick. Landslides of such dimensions are difficult to comprehend but probably could take place in front of large fault scarps or thrust plates moving on the surface. The mass could be a composite of several slides, but no field evidence suggesting this has been recognized.

Possibly the large outcrops of arkose and granodiorite breccia are not part of the Helmet fanglomerate but are part of the basement on which the fanglomerate was deposited. They could represent steep pre-Helmet hills that were buried by the fanglomerate; or they could have been emplaced by unrecognized intra-Helmet or post-Helmet faults.

In the SE¼ sec. 21, T. 17 S., R. 12 E., the red unit and part of the brown unit of the fanglomerate interfinger with thoroughly brecciated Cretaceous(?) rocks (pl. 1). The breccias are here interpreted as a composite of small landslides and possibly talus accumulations of Helmet age. The outcrops are poor, and some of the fingers could represent post-Helmet fault wedges. A great deal of brecciation and shearing is related in space to the San Xavier thrust, and some of the breccias tentatively assigned to the Helmet in this area are unquestionably thrust breccias, at least in part.

THICKNESS

The apparent thickness of the Helmet fanglomerate exposed south of Helmet Peak is about 10,500 feet. This section includes all parts of the formation exposed in the Pima district, but the section is faulted off at the top and therefore stratigraphically higher beds of unknown thickness and character are not represented.

No major faults duplicate the section, for the stratigraphic units—the red unit, andesite flows, brown unit, and gray unit—are not repeated. Major strike faults that cut out beds could exist, but none have been recognized. Small shear zones marked by concentrations of calcium carbonate cut the fanglomerate at some places, but neither the amount nor the direction of movement along them is known. Tiny faults offset some of the boulders (pls. 3 and 5, p. 97–98). Some of these faults would lead to overestimation and others to underestimation of the stratigraphic thickness. If the localities discussed on pages 97–98 are representative, the faulting would lead to slight overestimation, perhaps by 2 or 3 percent.

ORIGIN

The Helmet fanglomerate probably formed as fan deposits near the base of a tectonically active mountain mass. The predominant conglomerate facies is ill sorted, ill bedded, and characterized by angular to subangular fragments, suggesting rapid deposition near the source. The largest boulder found measured 8 by 7 by 4 feet and was evidently larger originally, for fragments recently broken from it littered the arroyo channel beneath the outcrop. A heterogeneous mixture of such large fragments with others as small as granules, all in an abundant fine-grained matrix, suggests emplacement as mudflows. The nearly monolithologic conglomerate units can be interpreted as mudflows or torrential stream deposits of localized source, and possibly as a result of interfingering of material from adjacent drainage channels.

Sedimentary structural features that might reveal the direction from which the material was carried are very scarce in the conglomerates. No crossbedding was found. At one locality, obscure imbrication suggests movement from the west, but in general the formation is too poorly bedded to determine whether the arrangement of the fragments is imbricate. Two shallow filled channels were found, which plunge S. 40° W. and S. 5° W., respectively. (See pl. 2.) If the bedding at the two localities is restored to an assumed original horizontal position by rotation about an axis parallel to the strike, the two channels trend S. 30° W. and S. 3° W., respectively. These few data suggest a source to the west or southwest.

While the conglomerates were accumulating, great masses of rock occasionally broke from the tectonically mobile source area and slid down the fan surface. These landslide blocks were buried by conglomerate and now appear as lentils and tongues of monolithologic breccia.

At one stage, porphyritic andesite lavas were poured out over the fan surface. Slightly later, thin interbeds of tuff and tuffaceous sediment were deposited as a result of explosive and probably more distant eruptions of rhyolitic rock.

The distribution of landslide material and the regional variations in the texture and composition of the conglomerates tend to confirm that the source area was to the west, and probably not far away. Landslides make up an increasing proportion of the formation toward the west; this increase strongly suggests a nearby source in that general direction. Tongues of breccia in the westernmost exposures could even represent ancient talus accumulations. A greater proportion of the conglomerates are monolithologic toward the west, and this further suggests a western source. In drill holes that have penetrated the formation northeast of its area of outcrop, the conglomerates are generally finer textured than those exposed. Evidently the source was to the west, but whether to the southwest, west, or northwest is not revealed by these data.

AGE AND CORRELATION

The only fossils that have been found in the Helmet fanglomerate are in boulders and breccia fragments, and are of Paleozoic age. Obviously these fossils indicate the age of the source rocks. Conclusions regarding the age of the fanglomerate must depend on lithology, geologic relations, and correlation with formations that can be dated by direct evidence.

The fanglomerate is younger than the ore deposits of the district and older than a subsequent orogeny. The fanglomerate contains boulders of the Late Cretaceous or early Tertiary intrusive bodies and of altered and mineralized Paleozoic and Cretaceous(?) rocks, indicating that these rocks were in existence and had been exposed by erosion at the time the fanglomerate was deposited. The fanglomerate now dips steeply and is cut by large faults, one of which, the San Xavier thrust, is of regional importance. The beds strike east-north-